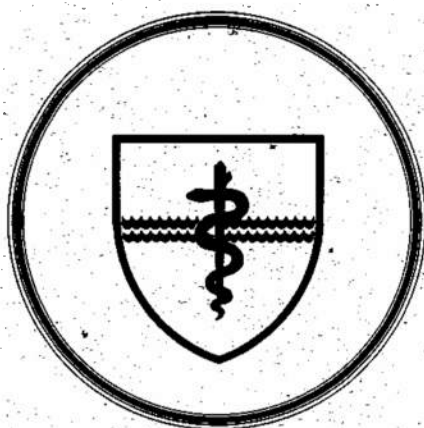


**NAVAL SUBMARINE MEDICAL
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**ATTITUDE CHANGES DURING A COLD WEATHER COMBAT EXERCISE:
An Exploratory Study**

by

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ABSTRACT

Exploratory in nature, this study was designed to identify some of the personality trait configurations and attitude change patterns related to individual differences in cold coping capacity (CCC). Three enlisted marines participated in a week-long cold weather North Atlantic Treaty Organization (NATO) combat exercise in upper Norway. The Minnesota Multiphasic Personality Inventory (MMPI) was administered prior to the exercise. Designed to measure the attitudes and expectancies associated with exposure to cold, a 50-item Cold Exposure Attitude Scale (CEAS) was administered to the 3 subjects before and after the exercise. The results showed that attitudes related to the perceived disorganization of the mission and its justification changed most negatively. On the other hand, attitudes regarding the encumbrance of cold weather gear and risk to health changed the most in a positive direction. Based upon selected patterns of MMPI scores, 2 of the subjects were assumed to typify persons with low and high cold coping capacity (CCC). Arguing at least for preliminary validity for this typology were significantly (5% level) different patterns of CEAS item changes (pre- and post-cold exposure) for the two types. The results of the study suggest novel methodological approaches to analyzing "cold" data and, at the same time, provide some plausible hypotheses as to possible trait configurations predictive of individual differences in CCC.

ATTITUDE CHANGES DURING A COLD WEATHER COMBAT EXERCISE:

An Exploratory Study

During the past twenty years a number of studies have focused upon various aspects of the problem of selecting men for assignment to both the arctic and antarctic regions. Clinical evaluations by psychologists and psychiatrists, biographical information, and personality tests have provided the basic data from which to predict individual and group adjustment and performance in these cold environments (Edholm & Gunderson 1973; Hanson & Goldman 1969; Weybrew, Molish and Youniss 1961; Nelson 1961; Mullen & Connery 1959). In the main, these studies have been limited to the civilians and military personnel stationed at various polar research facilities. A review of the literature indicates a paucity of substantive data dealing with individual differences in quality of adaptation to the conditions existing during cold weather combat. In a review of cold injuries in man, Hanson & Goldman (1969) pointed out that the selection of military combat personnel for cold area assignment typically has been done without regard to consideration to cold dysfunction and injury.

One commonly recognized factor concerning adaptability to hypothermic environments is that some men adapt well; others do not adapt well at all. Why? What are some of the underlying contributing factors that account for differences in the quality of the adjustment of Navy and Marine Corps personnel operating in cold environs? Given a combat battalion of Marines, all volunteers, how could a finite group of men (say 100) be identified with maximum odds to perform effectively in the field and who would demonstrate optimal quality of adaptation to the existing cold weather combat conditions.

One approach to answering this question as posed, would be to plan and initiate a large multi-disciplinary study (or series of studies) whereby the interactions of specific physiological, psychological, and environmental changes resulting from cold exposure are statistically manipulated so as to identify the predetermined effective and ineffective "adapters." Studies utilizing this approach have been proposed by the authors and others (Cold Research Proposal, 1979). Another

T A B L E 1

BIOGRAPHICAL DATA FOR THE THREE MARINE SUBJECTS

Subjects	Geographical Location of Home	Age	Sex	Years Education	Pay Grade	Years Active Duty	Marital Status	Previous Cold Weather Assignments
A	New Jersey	19	Male	11	E-3	1	Single	No
B	Illinois	20	Male	12	E-3	2.5	Married	No
C	Indiana	21	Male	12	E-4	2	Married	No

Physical Setting

The combat training exercise took place in the mountains of upper Norway in February of 1979. The temperature ranged from + 10° F to - 35° F, with mild winds. It snowed off and on during the entire seven-day exercise. The subjects' personal cold weather gear consisted of the standard U. S. Marine Corps issue. The men were berthed in unheated tents provided by the NATO forces participating in the exercise. All of the training operations were conducted in snow-covered terrain.

RESULTS

As expressed or implied in the introductory statements in this paper, the overall objective of this study is a heuristic one, namely to suggest directions or subject matter areas upon which future cold research should focus. Accordingly, the data were analyzed in such a way as to shed some light on the plausibility of at least three kinds of research questions: (1) Do men's attitudes related to cold exposure change remarkably when exposed to cold weather combat conditions, and to what degree, and in what directions are these changes ? (2) What is the content of those attitudes tending toward extreme changes in a positive and negative direction ? (3) Is the degree of attitude changes and the content of those attitudes changing most in a positive and negative direction different for selected personality types as identified by the MMPI ? The data analyses to follow address these questions in the same order.

Direction and Intensity of Attitude Changes

The bargraph in Figure 1 presents the attitude change data bearing on the question of direction and degree of change.

At the outset, a word of explanation regarding the meaning of the bargraph in Figure 1 would seem to be in order. In the first place, in order that the 50 item response changes (pre- to post-exposure) may be compared across the 3 subjects, the change-scores (corrected for adjudged favorableness) were

transformed to ipsative form (Cattell, 1944). This conversion was accomplished rather simply by calculating the means and standard deviations for each subject's array of 50 CEAS item changes. Standard or z-scores were then converted to T-scores (Means = 50 and SD = 10) for each item, for each subject. The bargraph in Figure 1 then is a percentage distribution (N = 50 CEAS items) of median item changes for the 3 subjects combined into class intervals of 5 T-score units each. Overall, although the degree of attitude changes in a negative direction appears to be somewhat greater than in the positive direction, these differences were not significant ($\chi^2 = 1.27$, $df = 1$, $p > .05$).

CEAS Item Content and Polarity of Changes

Table 2 presents abridged statements of the CEAS item responses tending to change most in a positive and a negative direction following cold exposure. Thus, it appears that attitudes related to the perceived irrelevance of the exercise and the presence of signs of confusion and disorganization associated with the mission itself tended to show the most extreme negative changes (items 15 and 19). Similarly, attitudes pertaining to the inopportunity for adequate personal hygiene and for satisfactory recreational activity also tended to change negatively (items 41 and 45), (See item list in appendix A).

On the other hand, the content of the items tending to change in a positive direction suggests that attitudes relative to man's perceived capacity to adapt readily to the cold in general, and to cold weather protective gear in particular tend to become more favorable after cold exposure (items 4, 12 and 34). Further, attitudes concerning the likelihood of adverse effects on one's health in general or proneness for depression and boredom tend to become more positive (items 9, 28 and 29). Finally, attitudes related to the inconveniences of using latrines in the cold become more favorable after the exercise (item 44).

Personality Types and Cold Coping Capacity (CCC)

One basic assumption underpinning this study is that certain personality types have more cold coping capacity (CCC) than others. Table 3 compares the polarity of the CEAS responses before and after the cold mission.

A Chi Square Test of Goodness of fit was used to analyze changes in the polarity of responses to the CEAS after the cold exposure. Only Subject A showed a significant change from pre- to post-cold exposure ($X^2 = 11.96$, $df = 2$, $p < .002$). It can be seen that the significant change resulted mainly from the fact that fewer neutral responses occurred following the cold experience. While the change data for Subject B showed the same trend, that is, fewer neutral responses following the cold exercise, these differences were not significant. In contrast, Subject C showed no change whatsoever in the proportion of neutral responses before and after the cold exposure.

These differences in attitude change patterns among the subjects suggest the hypothesis that individual differences in CCC may in part be accounted for in terms of a dynamic adaption concept called "cognitive dissonance" (Festinger, 1944). Dissonance theory, as it has come to be called, would lead to the interpretation that the greater the incongruence between the attitudes of subjects A, B and C regarding cold exposure, and the fact that they had freely volunteered for the mission, the greater will be the dissonance (subjective tension) aimed at reducing this incongruence. Apparently only for Subject A, whose neutral responses decreased 28% and positive responses gained 16%, was there at least inferred evidence of dissonance resolution. While unsubstantiated in the now voluminous literature of cognitive dissonance, a hypothetical question emerges, namely, is there a systematic relationship between individual differences in the tendency for dissonance resolution in a given stress situation and CCC? In any event, a search of the MMPI data to follow will be directed toward delineating hypothetical trait patterns possibly associated with these differences in dissonance dynamics.

In the interest of clarifying the content of the 13 standard MMPI scales and 5 experimental scales included in Table 4, a brief descriptive statement follows:¹

L, F and K scales measure test-taking attitudes; Hs, over-concern about one's own health; depressed or state anxiety; Hy, hysterical or dissociative; Pd, tendency toward asocial or dyssocial conduct; Mf, sex role identification; Pa, suspiciousness or delusional; Pt, trait or chronic characterological anxiety; Sc, degree of reality contact; Ma, level of psychic energy; Si, social withdrawal; A, situational or state anxiety; Es, ego resiliency; Dy, dependency needs; Cn, impulse control; and Do, general coping capacity.

While differences in the T-score arrays of the 18 MMPI scales are readily visible in Table 4, the overall profiles among the 3 subjects were not significantly different at the 5% level (Unpaired Replicates Test, Wilcoxin, 1945).

Two composite indices (Welsh & Dahlstrom, 1956) obtained by combining selected MMPI scale scores (in T-score form) have been found to be inversely correlated with the rate of rectal temperature recovery following brief cold exposure (Fine & Gaydos, 1959). Those indices are calculated by the following formulae (see Table 4 for interpretation of the MMPI scale abbreviations):

$$\text{Anxiety Index (AI)} = \frac{\text{Hs} + \text{D} + \text{Hy}}{3} + [(\text{D} + \text{Pt}) - (\text{Hs} + \text{Hy})]$$

$$\text{Internalization Ratio (IR)} = \frac{\text{HS} + \text{D} + \text{Pt}}{\text{Hy} + \text{Pd} + \text{Ma}}$$

In general, the earlier literature of the MMPI (Welsh & Dahlstrom, 1956) tends to support the findings that persons receiving AI scores in the T=40 - 60 range are considered to be within normal limits. On the other hand, scores above AI=60 suggest an anxiety disorder of some nature. As for IR, ratios close to or greater than "1" are described as "Internalizers", i.e., those

¹See Welsh & Dahlstrom (1956) for a detailed discussion of the standard MMPI scales and Duckworth and Duckworth (1975) for a succinct discussion of the experimental scales.

whose inadequate anxiety defenses result in unpleasant affect, often with somatic symptoms as concomitants. Conversely, "Externalizers", that is, those who handle emotional conflicts by acting out, tend to obtain IR indices less than unity, often approaching zero.

The AI scores for subjects A, B and C in the same order were 34, 40 and 48, while the IR values, still in the same order, were .46, 0.72 and 0.82. These differences among the 3 subjects for the 2 measures reached significance only at the 0.14 level (Friedman, 1937).

To provide some gross data bearing on the question of different CCC as indicated by CEAS attitude changes during cold exposure, the 50 CEAS item change scores in T-score form (Fig. 1) were combined with the 18 scales of the MMPI, also in T-score form, and the total arrays ($N = 68$) intercorrelated for the three subjects. The 3 Pearson Product Moment coefficients were identical, viz., 0.26, significant at the 5% level. These findings argue that while the interrelationships among the three subjects' profiles are nonchance, the relatively small size of the correlation coefficients suggests that there are still many differences in their patterns of attitude changes following the cold weather exercise. It might be mentioned in passing that the methodology involving the different change-patterns resulting from exposure to cold stress need not be restricted to attitude changes alone but might have included physiological, biochemical, and other indices as well.

A more focussed examination of the MMPI profiles of the three men suggested other hypotheses related to those personality trait patterns that might be predictive of individual differences in CCC. It is noted, for example, that all 3 men obtained scores at or above $T = 70$ (2 SD's above the mean of 50) on Hypomania, a scale which reliably measures the pool of "psychic energy" available to a given person (Duckworth & Duckworth, 1975). Although lacking in empirical validation, the hypomanic scale is hypothesized to constitute a moderator variable for CCC. Specifically, a person with a score less than $T = 65$ on this scale would be predicted to

T A B L E 5

Summary of Theoretical Bases for Hypotheses Regarding
Interrelationships of Personality Types and Cold Coping Capacity (CCC)

Quality of CCC	MMPI Patterns	Dissonance [†] Resolution	Psychoanalytic ^{††} Types	Locus of ^{†††} Control
High CCC	AI<50	Considerable	Ego-Syntonic	Externalizer
	IR<1.0			
Low CCC	AI>65	Very little	Ego-Dystonic	Internalizer
	IR>1.0			

* See Table 4 for explanation of abbreviations. Hypothetical score limits are:

High CCC: Ma 65-75, Pd < 70, Pt < 70. Low CCC: Hs, D, Hy, Pt, any 2 or more scales 70-80 and Es < 60. AI=Anxiety Index; IR=Internalization Ratio

† Festinger (1957) ; †† Jones, 1943 ; ††† Rotter, 1966.

T A B L E 6

Comparison of the Attitude Changes of Two Different Personality Types

CEAS	Abridged Statement of	Item Changes	(T-Scores)*
Item Number	Item Content	Subject A	Subject C
<u>Most Negative Changes: Subject A[†]</u>			
15 #	Mission disorganized and confused	33	70
19	Mission importance justifies expenditure of time	33	49
20 #	Time passes slowly	33	43
45 #	Personal hygiene difficult	33	52
<u>Most Negative Changes: Subject C[†]</u>			
13	Personnel adequately trained	59	31
14 #	Aches and pains much worse	64	31
17	NCOs/Officers high caliber	44	31
40	Medical supplies adequate	59	28
<u>Most Positive Changes: Subject A^{††}</u>			
4	Get used to cold quickly	70	61
12 #	Clothing is uncomfortable	64	67
28 #	Cold exposure causes depression	64	67
34	Clothing interferes very little	64	46
<u>Most Positive Changes: Subject C[†]</u>			
11 #	Leisure time activity a problem	44	70
29 #	One gets bored	59	64
43	Sleeping not a serious problem	44	67
47 #	Motivation drops	39	64

* Changes greater and less than T-score = 50 are positive and negative, respectively.

† Between subject differences significant, $p < .05$ by Unpaired Replicates Test (Wilcoxin, 1945)

†† Between subject differences not significant, $p > .05$ (op.cit.)

Indicates the item was adjudged "negative" in the sense that the more negative the response (i.e., towards the disagree end of the scale, Appendix B), the more "favorable" or positive is the respondent's adjustment.

resolution of the incongruence or dissonance between A's attitudes and expectancies regarding the cold mission and his decision to volunteer for this duty. While "B" showed a trend toward dissonance resolution, "C" showed virtually none.

4. While not statistically significant, there were, nonetheless differences among the MMPI profiles of the 3 subjects (Table 4). The substantive findings of this aspect of the study may be less important than the methodological implications for cold and other stress-related research. In this study, all of the scores for each subject are in the same units, namely, T-scores. The 18 MMPI scores in Table 4 as well as the 50 CEAS pre- and post-cold differences were significantly intercorrelated among the 3 subjects (.05 level).

The possibilities of this methodological approach for research dealing with the question of individual differences in Cold Coping Capacity (CCC) appear provocative. With modern computer technology, it is possible to calculate correlation matrices between 10 to 50 (or more) subjects over arrays of 2 to 200 or more measures obtained from each person. All in standard score form, the kinds of measures included may be many and varied: personality test scores and attitude-change measures as used in the present study, measures of tissue density, indices of cardiopulmonary, cardiovascular, biochemical and endocrinological function, and temperature gradients, to name a few possible parameters. Included also would be selected criteria of adaptation to cold, for example, ratings of quality of performance and emotional stability in the field, quality of overall general health, and injury record.

With a sample as small as the one in the present study ($N = 3$), the use of advanced multivariate techniques was prohibitive; however, with, for example, a sample of 20 subjects (actually 200 or more could be used) a 20 x 20, between-person (over arrays of measures) correlation matrix could be calculated to be subjected to Q-technique type of factor analysis

these comparison data suggest distinct differences in terms of attitudinal responses to cold. However, whether the "A" versus the "C" personality trait configurations do in fact distinguish between high and low CCC persons respectively is an empirical question to be answered by controlled experimentation.

Hopefully, the results of this exploratory study have provided suggestions as to possible methodological approaches as well as some plausible hypotheses pertaining to the trait configurations predictive of individual differences in CCC. Future studies along the lines indicated in this study, but involving larger subject samples and a more diverse battery of psychological and physiological measures should yield substantive insights into the mechanisms underlying man's capacity to adapt to extreme cold.

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